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A Sanitary and Bacteriological Survey Campobello Island, N.B. Shellfish Area N.B. 18

Atlantic Region
Surveillance Report
EPS-AR-77-7

A SANITARY AND BACTERIOLOGICAL SURVEY
CAMPOBELLO ISLAND, N.B.
SHELLFISH AREA N.B. 18

by

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ABSTRACT

During the period May 5 through June 2, 1976, a bacteriological and a physical sanitary investigation was conducted of shellfish area N.B. 18, Campobello Island, New Brunswick.

A total of 343 water samples were collected from the surrounding areas, and were tested for the presence of fecal coliform bacteria by the multi-tube decimal dilution M.P.N. method.

Median coliform levels of the survey area proved to be within the acceptable limit of 14 fecal coliform per 100 ml of sample, and the physical sanitary condition of the area was considered to be satisfactory.

Therefore, it is recommended that the existing shellfish closure 18-1 in Deep Cove, Campobello Island be rescinded.

RESUME

Du 5 mai au 2 juin 1976, on a fait une étude bactériologique et sanitaire des eaux du secteur coquillier N.B. 18 dans la région de l'île Campobello (Nouveau-Brunswick).

On a prélevé, pour analyse, 343 échantillons d'eau des secteurs avoisinants et on a compté les coliformes fécaux par la méthode des silutions décimales multiples (méthode du nombre el plus probable (NPP)).

Le nombre moyen de coliformes se trouvait en deçà de la limite acceptable de 14 par échantillon de 100 ml et les conditions sanitaries physiques étaient satisfaisantes.

On recommande donc d'annuler l'interdiction nº 18-1 frappant la récolte des mollusques dans 1'anse Deep (île Campobello).

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1 INTRODUCTION

The tidal waters of Passamaquoddy Bay, New Brunswick, surrounding Campobello Island and bordering the Canada - United States international boundary, was bacteriologically assessed through May 5 to June 2, 1976, by the Mobile Laboratory staff of the Environmental Protection Service, Atlantic Region.

The significant shellfish resource in the area both commercial and recreational, also the declining fish processing industry in the State of Maine warranted a re-assessment of the existing closure and other resource sections surrounding the island.

Kindrasky conducted a bacteriological survey of the island in 1966 and recommended the existing closure on Deep cove (Manuscript Report No. 66-11). Closure 18-1 is described in the New Brunswick Fisheries Regulations as follows: "The waters along the western shoreline of Campobello Island, Charlotte County, inside a straight line drawn south 36° 52' west astronomic from Survey Monument No. 1 as shown on the plan of Campobello Island and a straight line drawn 84° 30' west astronomic from Survey Monument No. 2 as shown on that plan."

Three small communities on the island comprise the total resident population of 1200: Welshpool (Pop. 350), Wilson's Beach (Pop. 700) and Head Harbour (Pop. 150). Each community is a fish landing center with a small supporting commercial industry. Wilson's Beach, the larger population center, has two fish processing plants; Jackson factory, 20 employees and Connors Sardine factory, 85 employees seasonally.

1.1 Area Description

Campobello Island, one of the larger islands in Passamaquoddy Bay, commonly identified with Roosevelt National Park and is frequented by numerous transient tourists. This historic site and the three small communities represent the total habitation of Campobello Island.

Mixed bush, hardwood, and softwood growth covers the island to the shoreline. The small streams and brooks are fed by surface runoff following rainfall.

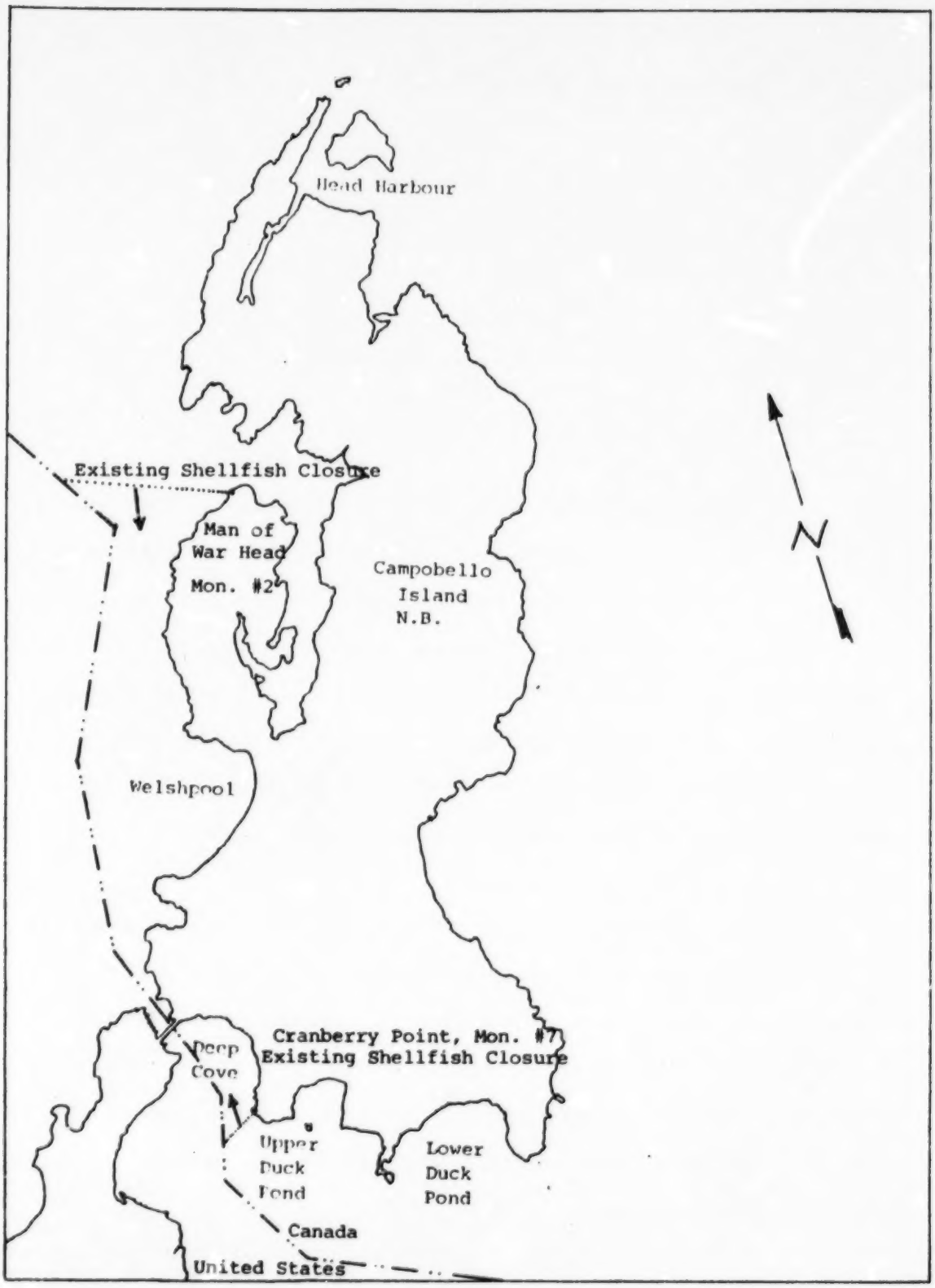
The fishing industry and related occupations are the principal sources of employment. The transient tourist industry is of minimal economic benefit to the island and is serviced normally by student employees.

Fundy tides that surround the island provide continuous dilution and flushing action, thus reducing incidental pollution to the receiving waters to a minimum effect.

1.2 Shellfish Resource

Periwinkles (Littorina littorea) and sea urchins (Strongylocentrotus drobachensis) are harvested commercially from low tide pools at the eastern end of the island. The 1975 harvest totalled 72,800 lbs.: 66,200 lbs. of periwinkles and 6,600 lbs. of sea urchins. Soft shell clams (Mya arenaria) are harvested from the western end of the island, the 1975 harvest totalled 23,800 lbs. of export.

The Fisheries and Marine Service office at Campobello estimates that the potential annual harvest from the area at present under closure would produce at least 25,000 lbs. annually if the current survey proves the area to be within the acceptable standards.



Natural Scale 1 : 72,800

FIGURE 1 - EXISTING SHELLFISH CLOSURE (18-1), CAMPOBELLO ISLAND, N.B.

2 MATERIALS AND METHODS

2.1 Sampling

Water samples were collected in sterile glass bottles at a depth of approximately one foot by means of a rod sampling device. All samples collected were held in an insulated cooler and transported to the mobile laboratory for analysis, less than one hour after collection.

2.2 Bacteriological Analyses

All water samples were tested for fecal coliform levels by the multiple tube dilution (MPN) method according to the A.P.H.A. "Recommended Procedures for the Bacteriological Examination of Sea Water and Shellfish" (A.P.H.A., 1970). Bacto-Lauryl Tryptose Broth was used as the presumptive test medium with incubation at 35±0.5°C for 24 and 48 hours, and positive cultures were transfered to Bacto-EC Medium and incubated in a water bath at 44.5±0.2°C for 24 hours. The most probable number (MPN) of fecal coliform bacteria was derived using a 5-tube dilution MPN table.

The criterion used for the classification of approved shellfish growing waters is a median fecal coliform value of 14 MPN per 100 ml with no more than 10 percent of the samples exceeding an MPN of 43 for a 5-tube decimal dilution test. In addition to bacteriological data, sanitary information on the study area is also included in assessing the closure.

2.3 Physical Data

To facilitate the interpretation of bacteriological data, the following physical parameters are also determined.

Salinities (ppt) were determined by the Knudsen Method (Annon, 1962) from water samples collected from selected stations (Appendix Table A-1). Water temperatures were also recorded at several stations. The tidal stage was estimated and recorded for the time period encompassing the beginning and end of each sampling run. Daily precipitation was collected and recorded at the Mobile Laboratory on site in the survey area. Measuring instruments and equipment were provided by Atmospheric Environment Service, Atlantic Region.

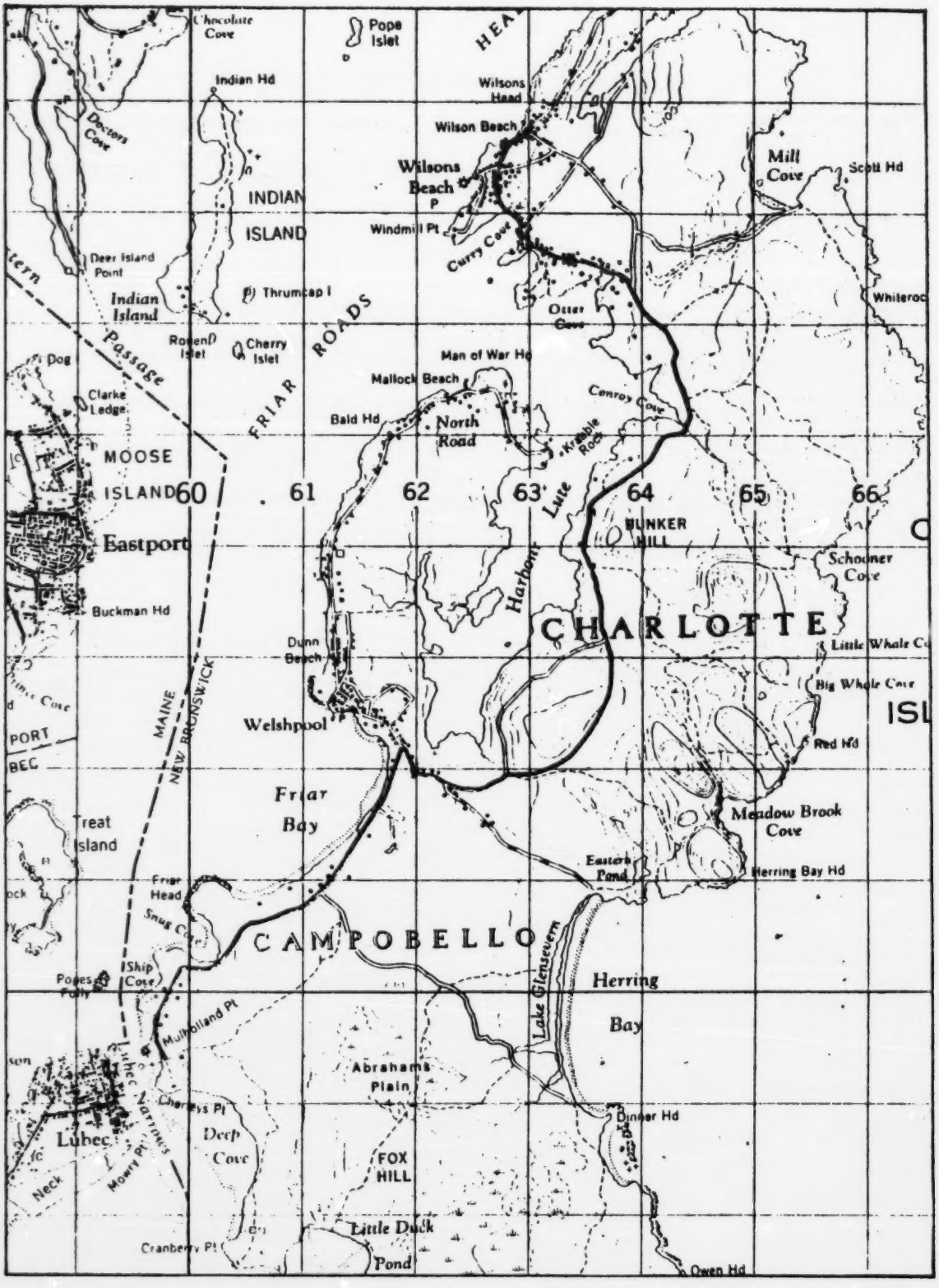
3 SANITARY CONDITIONS

The 1976 population on Campobello Island was 1200, occupying 430 homes. The increase during the summer months is estimated to be less than 500. This information was provided by the local post office and the Canada Customs and Immigration Office.

Two sources of industrial waste were visually evident at Wilson's Beach, both were from the fish processing industry (Figure 2). Jackson's factory processes ground fish and employs 20 persons at maximum production. The heavy solid waste from this operation is collected and used for lobster bait. The surplus is disposed of at the community dump. The sanitary waste from two washrooms discharge directly to the local waters. Plant processing water is pumped from near the harbour breakwater, 300 feet from the plant wharf at Figure 2.

Connors Sardine factory also located at Wilson's Beach employs 85 persons at maximum production. The sanitary waste from the washrooms drain directly to the local waters. Most solid waste from processing is shipped to Deer Island for fish meal production.

Domestic waste from the newer homes is treated by conventional septic tank with tile field systems. Older homes drain to dry wells or cesspools. Those on the shore line drain directly to the beach area.



SCALE 1: 50,000

FIGURE 2 - TOPOGRAPHIC MAP, CAMPOBELLO ISLAND, N.B.

Wilson's Beach is the larger of the three communities on the island (300 families). Homes in Welshpool and on the North Road (150 families) are more scattered in distribution.

Roosevelt International Park buildings are serviced for sanitary waste treatment and disposal by a 0.5 acre lagoon located 150 yards from the shore line high water mark.

The municipal dump is located in a wooded area near the center of the island remote from surface drainage to the shore line. Burning and burying is the usual means of disposal when accumulation becomes excessive.

A total of 17 wharves are in active use on the island; six in the Wilson's Beach area, six in the Head Harbour area, two at Windmill Point, one at Otter Cove, one at North Road and one at Welshpool.

4 CURRENTS, TIDES AND RAINFALL

4.1 Currents

Bay of Fundy tides surround Campobello Island with strong water currents. The normal current speed between the island and mainland (U.S.A.), is 7-9 knots as reported by the Fisheries and Marine Service at Welshpool.

The possibility of pollution emanating from the communities of Lubec and Eastport, Maine, and extending to Campobello Island was assessed by both bacteriological sampling and tracing current direction and velocity through a falling tidal phase. Sub-surface floats with vanes were set at two meters in depth and direction positions were recorded at 15 minute intervals. The various courses of tidal direction observed through a falling tide phase are indicated by the accompanying map (Figure 3).

These unusual patterns of drogue movement demonstrates that the large volume of water movement during a high falling tide, ebbs in a N.N.E. direction and reverses direction and flows through Head Harbour Passage. This effect is caused by the restricted or limited access through Lubec Channel. When the velocity and volume have sufficiently reduced, the general course again gradually changes and water ebbs through the Lubec Channel.

The mixing and dilution activated by travel times, distance and volume reduced any residual pollution from the Eastport sector to undetectable proportions.

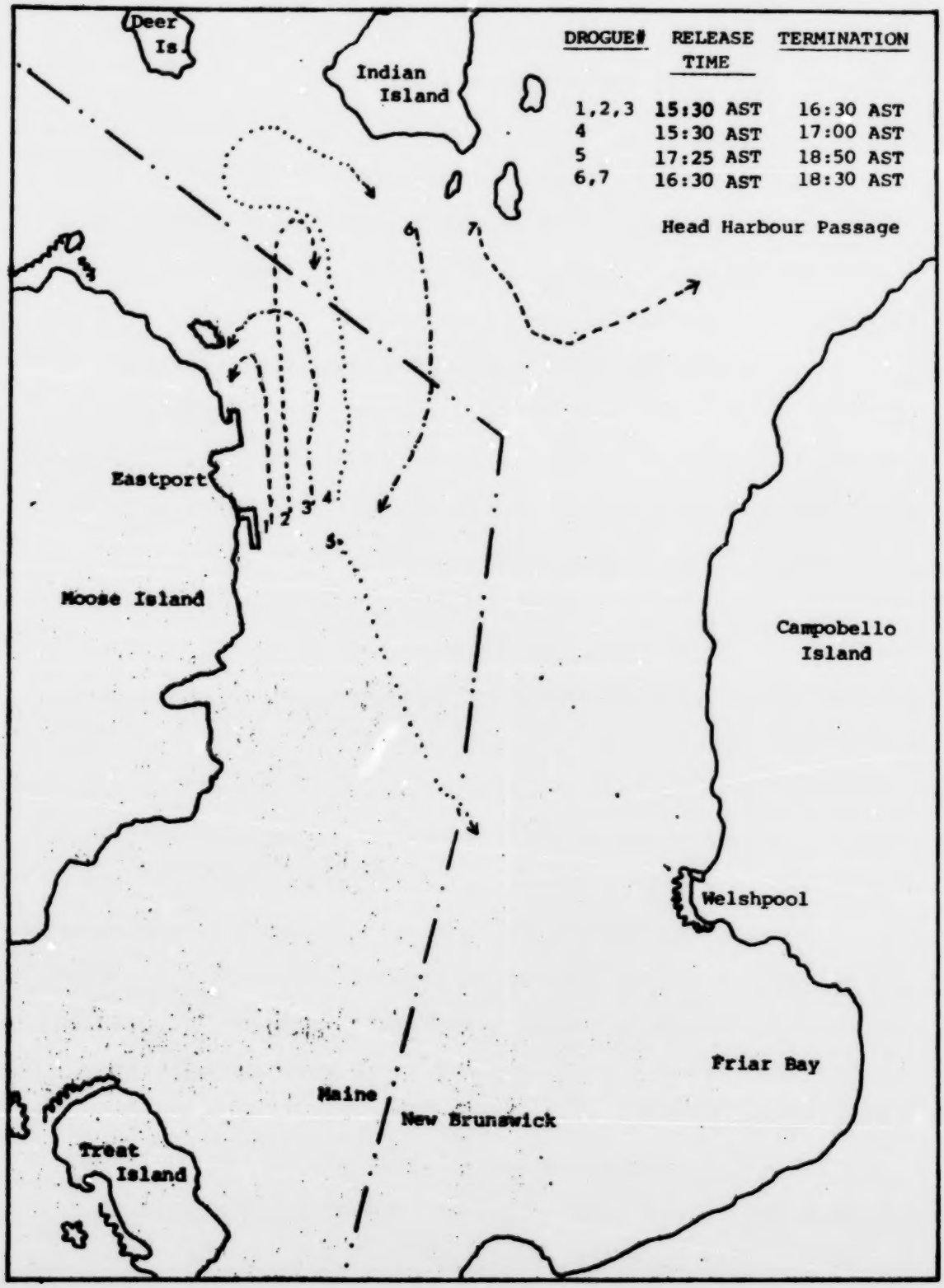


FIGURE 3 - DROGUE STUDY JUNE 1, 1976
HIGH TIDE 13:30 AST, LOW TIDE 19:55 AST

4.2 Tides

The hydrographic map of the study sector (4373) indicates the irregular directions of water movement in both the rising tide and the ebb flow (Appendix Figure A-1).

The tidal range for the area is from 6 ft. to 24.5 ft. and a mean tide of 18.4 ft. as reported by the Canadian Hydrographic Service, 1976 tides and current tables.

4.3 Rainfall

The survey period extended 29 days from May 5 through June 2, 1976. Daily records of weather conditions were maintained by the laboratory personnel, using instruments and equipment provided by Atmospheric Environment Service, and are presented in Appendix Table A-2 of this report. On May 8, 2.15 ins. or 5.5 cm. of rain was recorded through the night, followed by three days of fair and sunny weather. The induced landwash following this storm event produced no detectable effect on the receiving waters surrounding Campobello Island.

5 BACTERIOLOGICAL RESULTS

A total of 343 water samples were collected from 86 stations and analysed for the presence of fecal coliform bacteria, by the approved standard method (APHA, 1970). In total five sectors were surveyed: Deep Cove, Upper and Lower Duck Ponds, Friar's Bay, Harbour de Lute and Head Harbour (Appendix Figure A-2). The time of sampling and tidal phase is given for each sector in Appendix Table 3. The location of sampling sites in each sector are given in Appendix Figures A-3, A-4, A-5, A-6 and A-7. Results of fecal coliform analyses are given in Appendix Tables A-4, A-5, A-6, A-7 and A-8.

A summary of the bacteriological results obtained for each sector is presented in Table 1.

TABLE 1 - SUMMARY OF FECAL COLIFORM DATA FOR CAMPOBELLO ISLAND, 1976

SECTOR	MEDIAN	90% MPN/100 ml
Deep Cove	<2	<2
Upper Duck and Lower Duck Coves	<2	<2
Harbour de Lute	<2	<2
Friar's Bay	<2	<2
Head Harbour	<2	<2

The median fecal coliform level in each of the sectors of this study area were <2, well within the acceptable limit of 14 per 100 ml. In all sectors 90 percent of the samples were less than 43 MPN/100 ml. The only fecal coliform counts of significance were observed at Wilson's

Beach and at the Government Wharf at the Head Harbour. In each instance these counts occurred once during the survey period and were restricted to two or three sampling stations, within the mandatory 400 ft. wharf closures.

6. DISCUSSION

These data from each of the sectors under study indicate satisfactory bacteriology water quality during the survey period. This favourable condition is considered to be due to a number of contributing factors: such as the very high dilution factor of the fundy tides; the rapid movement of water exchange, producing a maximum flushing effect; and the proportionally small amount of pollutant material entering the shore line water, emanating from the fish processing industry and private dwellings.

Rainfall for the area during the survey period produced no detectable increase in the bacteria count. Samples collected May 8-9, following 2.15 inches of rainfall the night of May 8, were all within the acceptable bacteriological limit. Water courses and streams are small and low in flow volume; the only significant flow volume occurred following rainfall periods.

The 1966 survey of the area also found acceptable water quality within the present closure but recommended its retention due to concern over the potential influence of contamination sources at Lubec and Eastport on the adjacent shore line areas of Campobello Island. The bacteriological

results consistently fail to support this supposition. This situation however, can be explained by obvious hydrographic factors. The extremely large tidal amplitude coupled with the physiography of area results in very strong tidal currents throughout the sector. Thus the large volume of water, and the intense mixing results in rapid dilution of wastes discharged in Maine. In the Eastport area the pattern of water movement also further enhances this effect. As indicated by the drogue studies, on the falling tide wastes discharged at Eastport move rapidly north away from Campobello Island for the first hour and one half of the ebb tide. Thus wastes are exposed to several hours of intense mixing prior to any entry into Canadian waters. This factor mitigates against the occurrence of high fecal coliform levels on Campobello Island waters orginating from Eastport.

7 CONCLUSIONS

It may be concluded that:

A The physical sanitary inspection of the surrounding shore line and watershed revealed no significant sources of pollution entering the shore line waters other than those as noted within a mandatory closure.

B The bacteriological data of this report illustrates the satisfactory water quality throughout the study area and is in compliance with national standards for shellfish harvesting waters.

Therefore, it is recommended that closure 18-1 on Deep Cove, Campobello Island be rescinded.

8 RECOMMENDATIONS OF THE MARITIME STANDING COMMITTEE ON SHELLFISH

The existing closure 18-1 on Campobello Island is no longer necessary and should be rescinded.

REFERENCES

1 American Public Health Association. Recommended Procedures for the Examination of Sea Water and Shellfish. pp 105 (1970).

2 Donnelly, J.P. 1976. A Sanitary Engineering Survey Report Grand Manan Island, Deer Island and Campobello Island.

3 Kindrasky, G. Dept. of National Health and Welfare. Public Health Engineering Division. Manuscript Report No. 67-11.

4 Canada Hydrographic Service, Ottawa. Chart No. 4373.

ACKNOWLEDGEMENTS

The authors gratefully acknowledge the assistance of Mr. M. McCormick and Mr. K. Burdett for their participation in the survey, and Mr. M. Calder, the local Fisheries and Marine Service Officer, Canadian Customs and Immigration offices at Campobello, for providing utility services to the laboratory and statistical data of the area.

Particular appreciation is extended to Mr. J. Machell for the reviewing of this manuscript.

APPENDIX

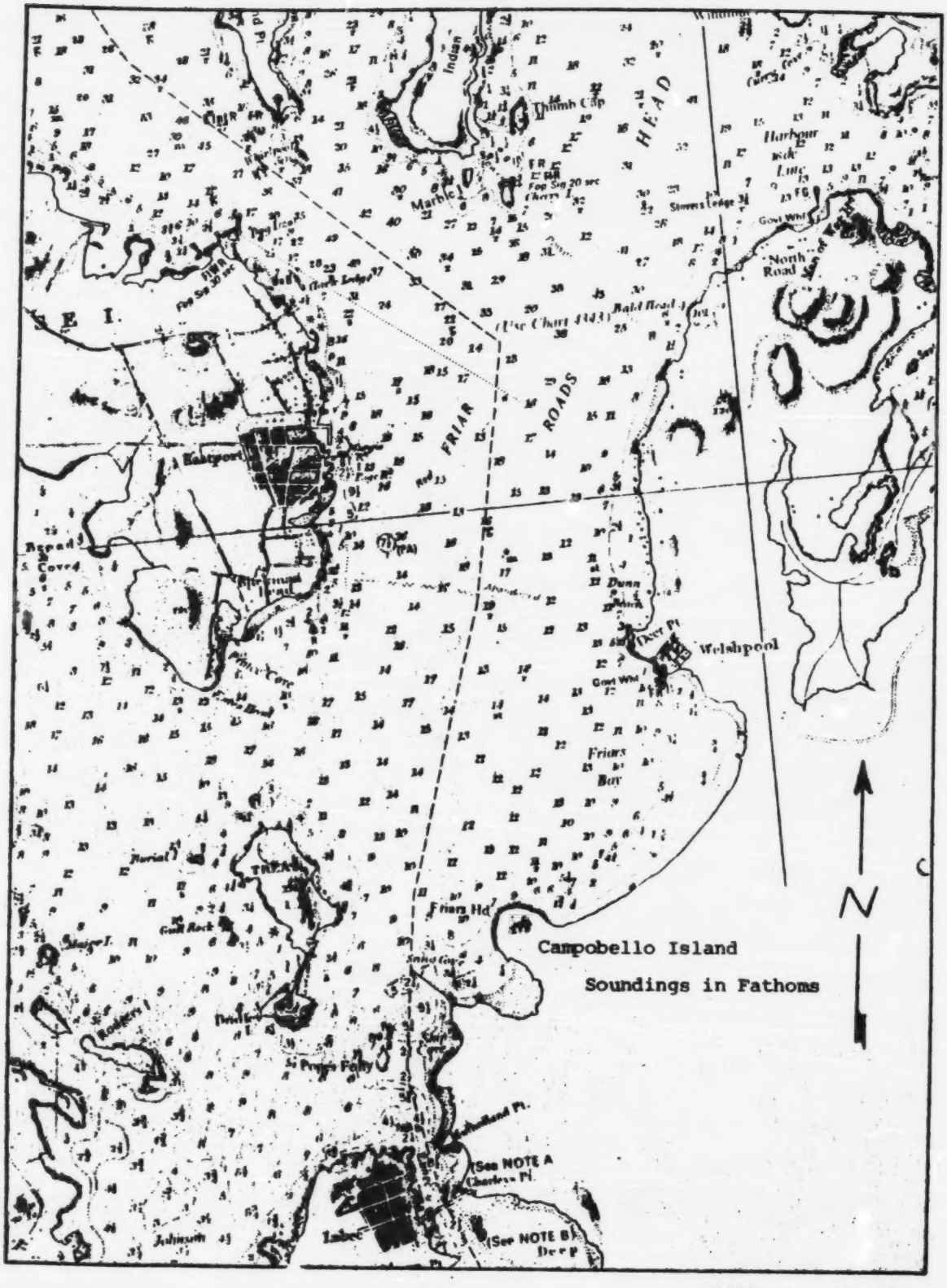


FIGURE A-1- HYDROGRAPHIC CHART, CAMPOBELLO ISLAND - #4373

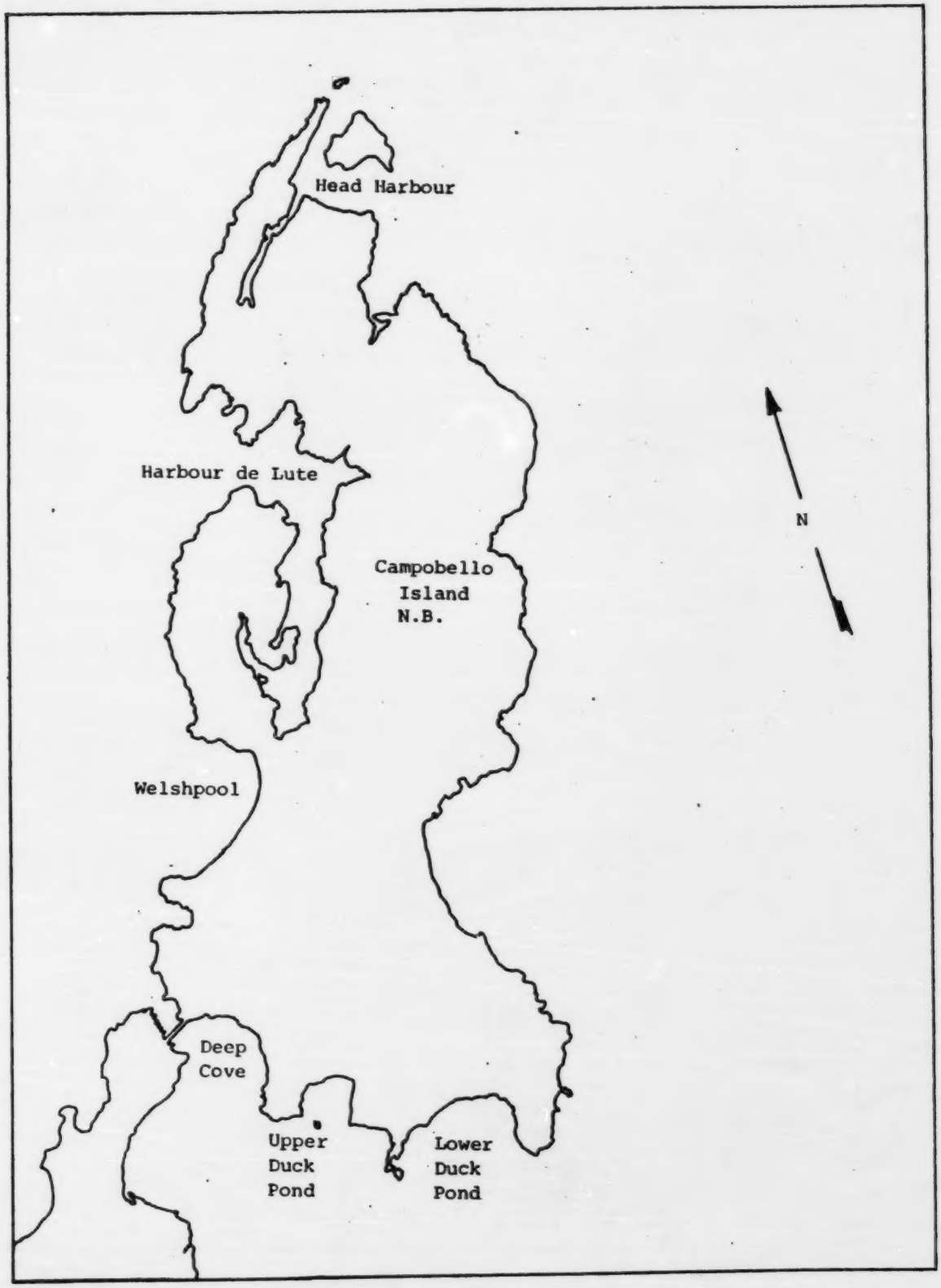


FIGURE A-2 SECTORS SURVEYED ON CAMPOBELLO ISLAND, 1976

Natural Scale 1 : 72,800

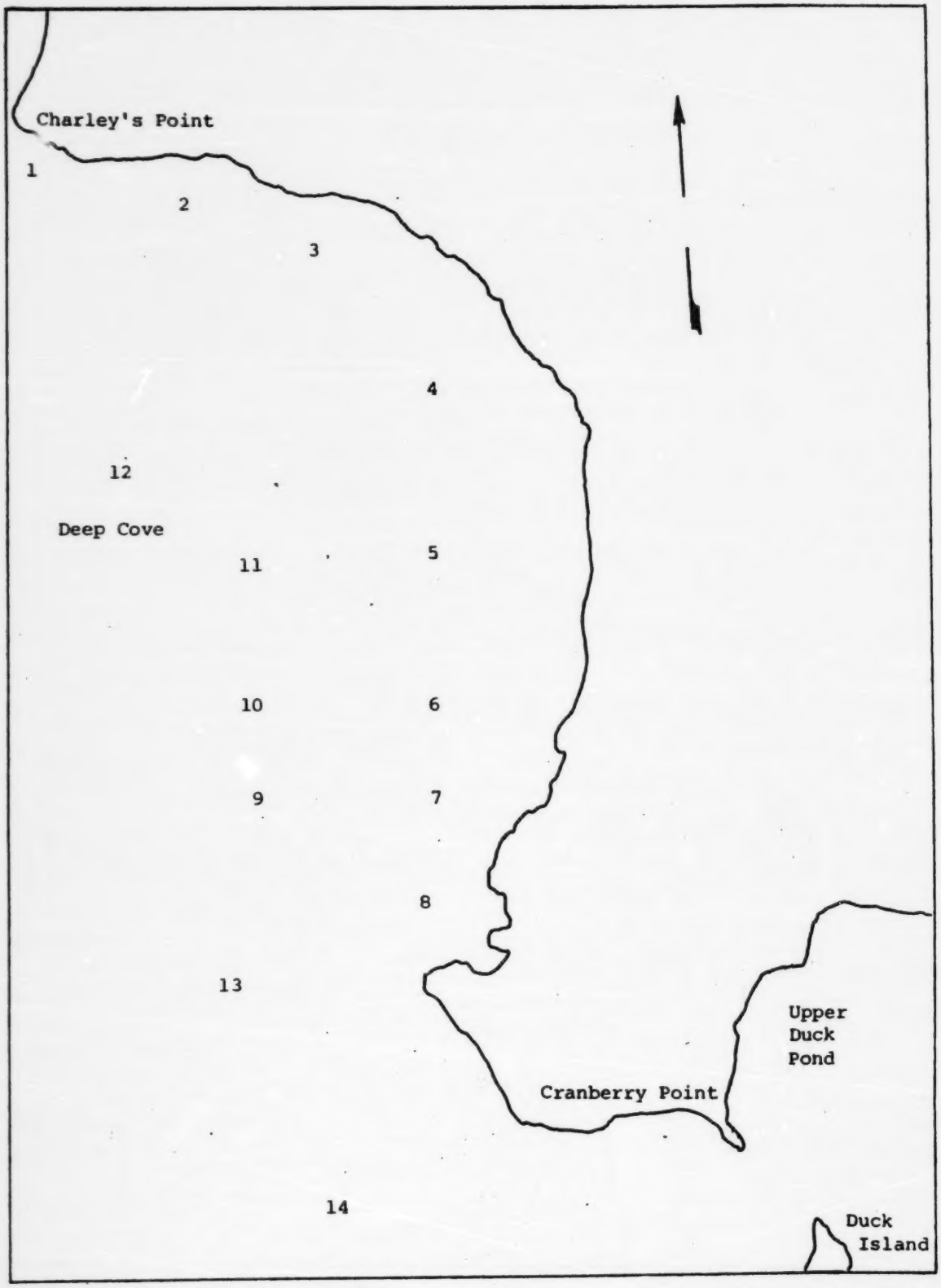


FIGURE A-3 SAMPLING STATIONS, DEEP COVE, 1976

Natural Scale 1 : 8,520

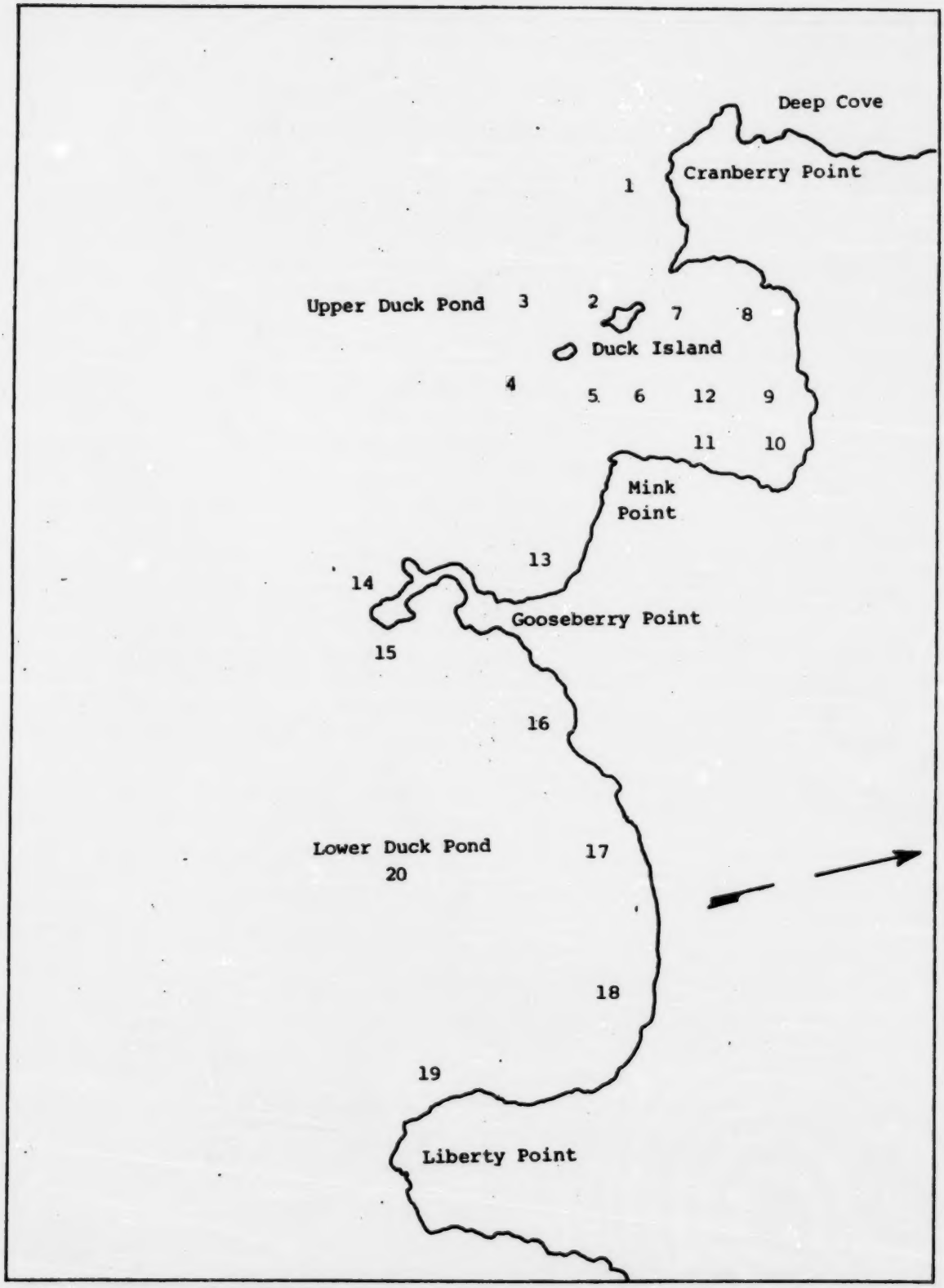


FIGURE A-4 SAMPLING STATIONS, UPPER AND LOWER DUCK PONDS, 1976

Natural Scale 1 : 8,520

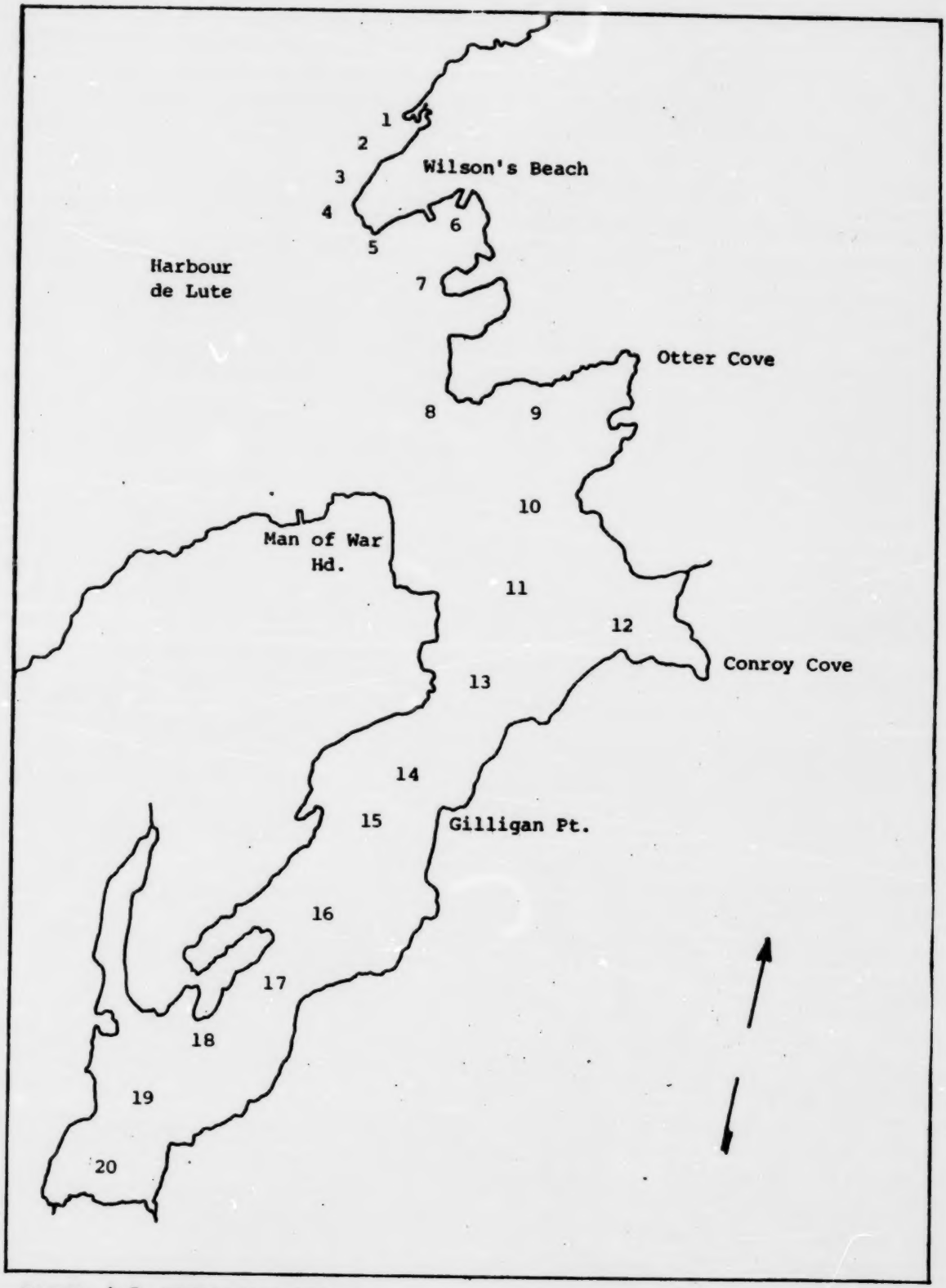


FIGURE A-5 SAMPLING STATIONS,
HARBOUR DE LUTE, 1976

Natural Scale 1 : 6,250

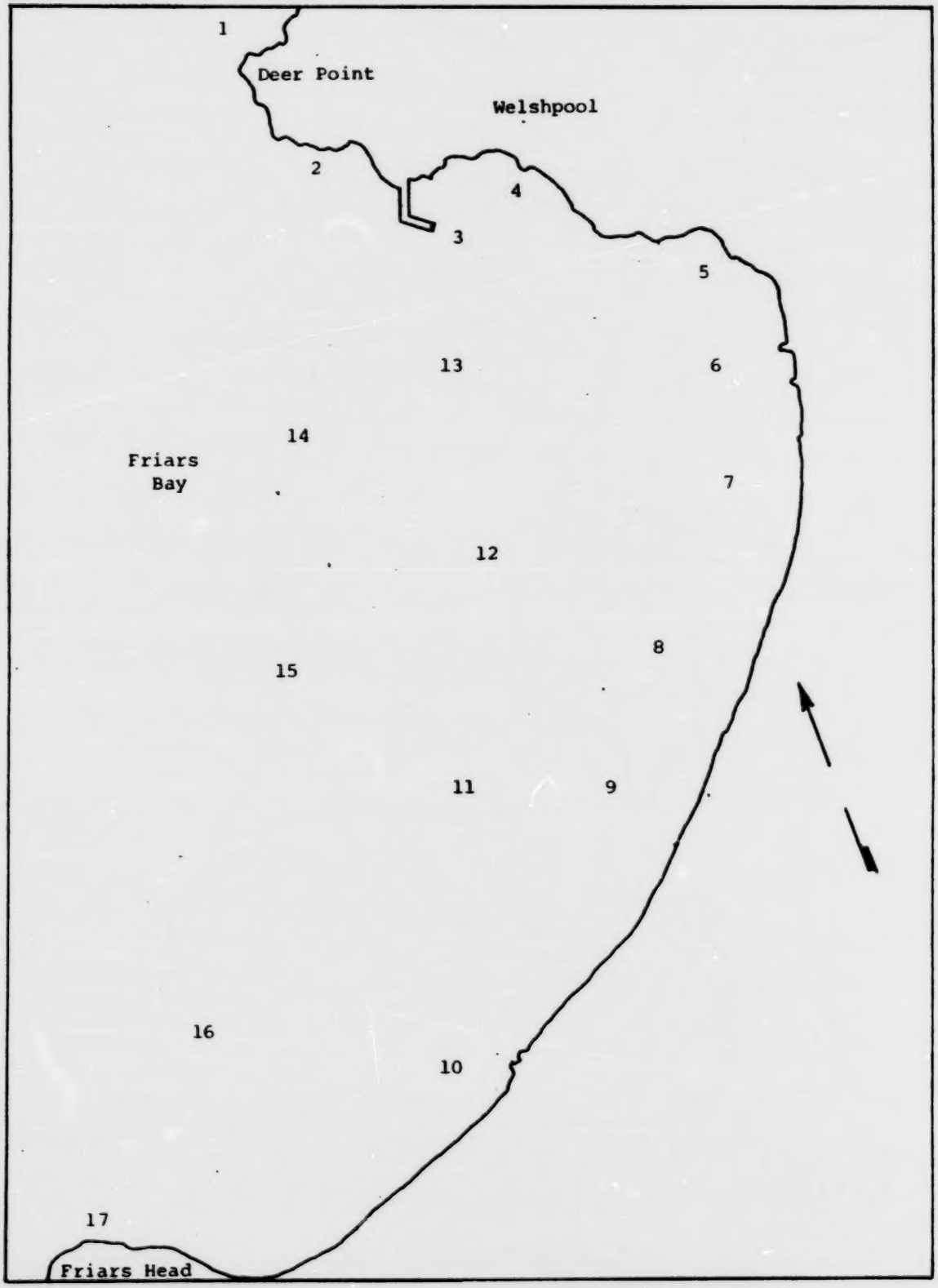


FIGURE A-6 SAMPLING STATIONS, FRIAR'S BAY, 1976

Natural Scale 1 : 8,520

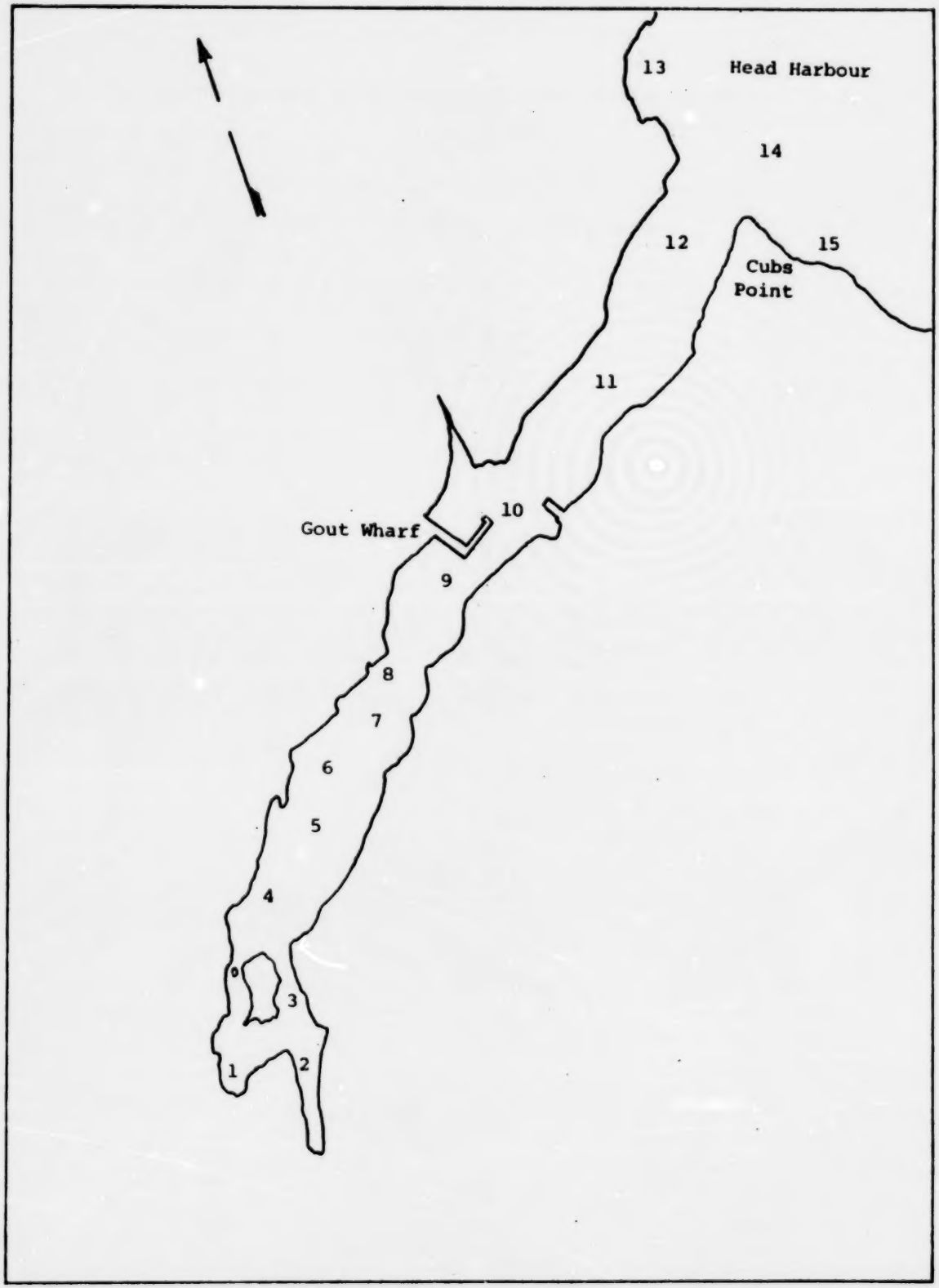


FIGURE A-7 SAMPLING STATIONS, HEAD HARBOUR, 1976

Natural Scale 1 : 8,520

TABLE A-1 - TEMPERATURE AND SALINITY DATA FOR CAMPOBELLO ISLAND, N.B., 1976

LOCATION	STATION NO.	DATE	TEMPERATURE °C	SALINITY °/₀₀
Deep Cove	1	May 7	6	31.8
		May 8 (AM)	6	33.7
		May 8 (PM)	6	31.4
		May 9	6	31.0
		May 21	6	31.8
	4	May 7	6	31.8
		May 9	6	31.0
Upper Duck and Lower Duck Ponds	6	May 7	6	31.8
		May 8 (PM)	6	31.1
		May 9	5.5	31.0
		May 21	6	27.8
	17	May 7	5	31.8
		May 8 (AM)	5	33.7
		May 8 (PM)	6	31.1
		May 9	5	31
		May 21	6	31.8
Friar's Bay	2	May 20 (AM)	7	31.8
		May 20 (PM)	6	31.1
		May 23	8	30.1
	8	May 23	7	30.1
	12	May 20 (AM)	7	31.8
		May 20 (PM)	6	31.1
	16	May 20 (AM)	7	31.8
		May 20 (PM)	6	31.1
		May 23	7	28.8

.../Continued

TABLE A-1 - CONTINUED

LOCATION	STATION NO.	DATE	TEMPERATURE °C	SALINITY °/oo
Harbour de Lute	1	May 6	5.5	29.5
		May 8	6	32.4
		May 9	6	33.7
		May 20	7	31.8
		May 23	7	30.1
	8	May 6	6	29.5
		May 8	6	31.0
		May 9	6	31.1
		May 20	7	31.8
		May 23	7	28.9
	17	May 6	6	29.4
		May 8	8	26.1
		May 9	6	32.4
		May 20	7	31.8
		May 23	8	29.4
Head Harbour	3	May 21	6	29.1
		May 23		30.4
	3B	May 23	7°	
	14	May 21	6	31.8
		May 23		31.8
	14B	May 23	7°	

TABLE A-2 - PRECIPITATION DATA FOR CAMPOBELLO ISLAND DURING THE STUDY PERIOD 1976

DATE	PRECIPITATION (INCHES)	SAMPLING DATES
May 6		*
May 7	.17	*
May 8	2.15	*
May 9		*
May 10		
May 11		
May 12	.65	
May 13	.36	
May 14		
May 15	.05	
May 16		
May 17		
May 18	.06	
May 19	.83	
May 20	T	*
May 21	.18	*
May 22	.17	*
May 23	.07	*
May 24	.10	
May 25	.02	
May 26		
May 27		
May 28		
May 29		
May 30		
May 31		

TABLE A-3 - TIDE STAGE AND TIME OF SAMPLING, CAMPOBELLO ISLAND, N.B., 1976

LOCATION	DATE	TIME OF SAMPLING (HRS.)	TIDE
Deep Cove	May 7	08:30-10:00	High-Mid Falling
Upper Duck and	May 8	11:00-14:00	Low Rising
Lower Duck Ponds	May 8	19:30-20:30	High Falling
	May 9	08:30-09:15	High Falling
	May 21	09:00-09:30	High Falling
Harbour de Lute	May 6	15:30-16:30	High Rising
	May 8	14:00-15:00	Low Rising
	May 9	09:15-09:45	High Falling
	May 20	09:15-09:30	Mid Falling
	May 23	09:00-09:30	High Falling
Head Harbour	May 21	07:30-08:00	High Falling
	May 22	16:00-16:15	Low Rising
	May 23	08:30-08:45	High Falling
Friar's Bay	May 20	09:50-10:10	Mid Falling
	May 20	14:15-14:45	Low Rising
	May 23	09:40-10:00	High Falling

TABLE A-4 - FECAL COLIFORM DATA, DEEP COVE, 1976

STATION NUMBER	MPN'S PER 100 ML					MEDIAN
	MAY 7	MAY 8 (AM)	MAY 8 (PM)	MAY 9	MAY 21	
1	<2	7	2	<2	<2	<2
1B					2	2
2	2		<2	<2	2	<2
3			<2	<2	5	<2
4	<2		<2	2	<2	<2
5	<2			2	2	2
6	2		<2	2	2	2
7	<2		2	5	2	2
8	<2		8	2	<2	<2
9	<2	6	<2	<2	2	<2
10	<2	8	<2	<2	<2	<2
11	<2	4	2	2	7	2
12	<2	2	<2	2	<2	<2
13	2	2	4	2	<2	2
14	<2	14	2	<2	<2	<2

TABLE A-5 - FECAL COLIFORM DATA, UPPER DUCK AND LOWER DUCK PONDS, 1976

STATION NUMBER	MPN'S PER 100 ML					
	MAY 7	MAY 8 (AM)	MAY 8 (PM)	MAY 9	MAY 21	MEDIAN
1	2	2	5	<2	4	2
2	2	-	2	<2	<2	<2
3	<2	<2	2	5	<2	<2
4	2	5	<2	2	2	2
5	<2	-	<2	2	<2	<2
6	<2	-	2	5	4	3
6B	-	-	-	-	<2	<2
7	2	-	<2	2	7	2
8	-	-	-	-	2	2
9	-	-	-	-	7	7
10	2	-	2	2	7	2
11	-	-	-	-	<2	<2
12	-	-	-	-	<2	<2
13	2	<2	2	17	4	2
14	<2	6	2	<2	9	2
15	2	2	2	2	<2	2
16	<2	-	<2	<2	<2	<2
17	<2	<2	<2	2	<2	<2
18	<2	<2	<2	<2	<2	<2
19	2	2	<2	<2	<2	<2
20	<2	<2	<2	<2	<2	<2

TABLE A-6 - FECAL COLIFORM DATA, HARBOUR DE LUTE, 1976

STATION NUMBER	MPN'S PER 100 ML					
	MAY 6	MAY 8	MAY 9	MAY 20	MAY 23	MEDIAN
1	2	2	5	<2	11	2
2	<2	2	<2	23	33	2
3	<2	<2	<2	<2	110	<2
4	<2	2	<2	<2	<2	<2
5	5	5	<2	5	2	5
6	2	11	<2	2	<2	2
7	<2	6	2	<2	<2	<2
8	<2	2	<2	2	<2	<2
9	<2	9	2	8	<2	2
10	2	16	2	8	5	5
11	<2	9	5	5	<2	5
12	<2	2	4	8	<2	2
13	2	6	2	23	<2	2
14	4	<2	2	13	<2	2
15	<2	13	<2	13	<2	<2
16	<2	2	<2	2	<2	<2
17	<2	23	<2	8	<2	<2
18	<2		2	13	<2	<2
19	<2		<2	23	2	<2
20	<2		5	2	<2	<2
17B					<2	<2

TABLE A-7 - FECAL COLIFORM DATA, FRIAR'S BAY, 1976

STATION NUMBER	MPN'S PER 100 ML			MEDIAN
	MAY 20 (AM)	MAY 20 (PM)	MAY 23	
1	<2	<2	<2	<2
2	5	2	7	5
3	<2	<2	<2	<2
4	<2	<2	4	<2
5	2	2	5	2
6	2	<2	2	2
7	<2	<2	2	<2
8	<2	<2	2	<2
9	5	<2	<2	<2
10	<2	2	<2	<2
11	<2	4	<2	<2
12	<2	<2	<2	<2
13	<2	<2	<2	<2
14	<2	<2	<2	<2
15	<2	<2	<2	<2
16	<2	5	<2	<2
17	<2	2	<2	<2
2B		<2		<2
12B		5	<2	<4
16B		<2		<2

TABLE A-8 - FECAL COLIFORM DATA, HEAD HARBOUR, 1976

STATION NUMBER	MPN'S PER 100 ML			MEDIAN
	MAY 21	MAY 22	MAY 23	
1	<2		2	<2
2	<2		17	<10
3	<2	2	7	2
4	<2	33	2	2
5	2	<2	2	2
6	22	<2	<2	<2
7	5	<2	2	2
8	49	<2	2	2
9	220	<2	<2	<2
10	13	5	2	5
11	4	<2	8	4
12	<2	<2	5	<2
13	<2	<2	<2	<2
14	2	<2	<2	<2
15	<2	<2	<2	<2
3B	<2	<2	5	<2
14B	<2	<2	<2	<2